

38-52

An electroluminescence display device comprising:

a substrate; and

a plurality of pixels over the substrate, each of the plurality of pixels comprising:

a switching element comprising at least two thin film transistors;

a current control element comprising a gate electrode electrically connected to the switching element; and

an electroluminescence element electrically connected to the current control element,

wherein each of the switching element and the current control element has at least one lightly doped impurity region between a channel region and one of source or impurity regions where the lightly doped impurity region of the switching element does not overlap a gate electrode of the switching element and the lightly doped impurity region of the current control element overlaps a gate electrode of the current control element at least partly.

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~~38~~ An electroluminescence display device according to claim ~~52~~, wherein the substrate comprises a material selected from the group consisting of a glass, a glass ceramic, a quartz, a silicon, a ceramic, a metal, and a plastic.

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54. An electronic device comprising the electroluminescence display device according to claim 52, wherein the electronic device is at least one selected from the group consisting of a video camera, a digital camera, a goggle type display, a car navigation system, a personal computer, a mobile computer, a portable telephone, an electronic book, an image playback device using a recording medium.

REMARKS

In response to the Office Action, claims 11-13 has been canceled. Claims 1-10 and 14-16 have been amended. New claims 17-54 have been submitted for the Examiner's consideration. Accordingly, claims 1-10 and 14-54 are pending, of which claims 1, 2, 3, 17, 25, 29, 33, 38, 41, 44, 49 and 52 are independent.

Claims 1-16 have been rejected under 35 U.S.C. 112, second paragraph. Claims 14-16 have been rejected under 35 U.S.C. 112, first paragraph. Applicants respectfully submit that the amendments to the claims fully address the Examiner's concerns.

Claims 1, 2, 5, 6, 11 and 12 are rejected under 35 U.S.C. 102 as being unpatentable as shown by U.S. Patent No. 5,684,365 to Tang et al. (Tang).

Amended claim 1 recites an electroluminescence display device comprising a substrate and a plurality of pixels over the substrate. Each of the plurality of pixels comprise a first thin film transistor and a second thin film transistor comprising a gate electrode electrically connected to the first thin film transistor. An electroluminescence element is electrically connected to the second thin film transistor. The first thin film transistor comprises an active layer in which two or more channel regions connected in series are formed.

Amended claim 2 recites an electroluminescence display device comprising a substrate; and a plurality of pixels over the substrate. Each of the plurality of pixels comprise a first thin film transistor and a second thin film transistor comprising a gate electrode electrically connected to the first thin film transistor. An electroluminescence element electrically connects to the second thin film transistor. The first thin film transistor comprises an active layer in which two or more channel regions connected in series are formed. A channel width of the second thin film transistor is greater than a channel width of the first thin film transistor.

The thin film transistor of the present invention has a multi gate structure, that is, the thin film transistor has at least two channel regions, see the specification, page 8, lines 6-16, and Figs. 1-2. The multi gate structure is extremely effective in lower a value of off current (e.g. Spec. page 8, lines 12-13). By realizing a switching element having a sufficiently low off current value, it becomes possible to eliminate the capacitor which causes a reduction in the effective luminescence surface area, and it becomes possible to increase the effective luminescence surface area. Thus, the image quality of the electroluminescence display device can be made brighter (Spec. page 9, lines 8-17).

In contrast, Tang does not disclose or suggest a multi-gate structure, i.e., a thin film transistor having an active layer "in which two or more channel regions connected in series are formed", as recited in amended claims 1 and 2. Therefore, claims 1, 2 5, 6 and 10 are allowable.

Claims 1, 2, 5, 6, 11 and 12 are rejected under 35 U.S.C. 102 as being unpatentable as shown by Japanese Patent document 10-189252 to Hosokawa.

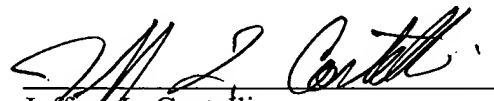
Like Tang, Hosokawa does not disclose or suggest a multi-gate structure, i.e., a thin film transistor having an active layer "in which two or more channel regions connected in series are formed", as recited in amended claims 1 and 2. Therefore, claims 1, 2 5, 6 and 10 are allowable.

Claims 14-16 have been rejected under 35 U.S.C. 103 as being unpatentable over Tang in view of Hosokawa.

For the reasons set forth above, neither Tang nor Hosokawa, either alone or in combination, disclose or suggest the claimed subject matter. Therefore, claim 1-10 and 14-16 are allowable over the prior art of record.

Given the above, Applicants respectfully submit that the application is now in condition for allowance. A prompt passage to issuance is therefore earnestly solicited.

Respectfully submitted,



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Enclosures

MARKED-UP VERSION OF AMENDED CLAIMS

1. (Amended) An [electro-optical] electroluminescence display device [which comprises a pixel] comprising:

a substrate; and

a plurality of pixels over the substrate, each of the plurality of pixels comprising:

a first [TFT] thin film transistor;

a second [TFT which comprises] thin film transistor comprising a gate electrode [that is] electrically connected to the first [TFT] thin film transistor; and

an [EL] electroluminescence element electrically connected to the second [TFT] thin film transistor,

wherein the first [TFT] thin film transistor comprises an active layer in which [2 or greater number of] two or more channel [forming] regions connected in series are formed.

2. (Amended) An [electro-optical] electroluminescence display device [which comprises a pixel] comprising:

a substrate; and

a plurality of pixels over the substrate, each of the plurality of pixels comprising:

a first [TFT] thin film transistor;

a second [TFT which comprises] thin film transistor comprising a gate electrode [that is] electrically connected to the first [TFT] thin film transistor; and

an [EL] electroluminescence element electrically connected to the second [TFT] thin film transistor,

wherein the first [TFT] thin film transistor comprises an active layer in which [2 or greater number of] two or more channel [forming] regions connected in series are formed, and

wherein a channel width of the second [TFT] thin film transistor is greater than a channel width of the first [TFT] thin film transistor.

3. (Amended) An [electro-optical] electroluminescence display device [which comprises a pixel] comprising:

a substrate; and

a plurality of pixels over the substrate, each of the plurality of pixels comprising:

a first [TFT] thin film transistor;
a second [TFT which comprises] thin film transistor comprising a gate electrode [that is]
electrically connected to the first [TFT] thin film transistor; and
an [EL] electroluminescence element electrically connected to the second [TFT] thin film transistor,

wherein at least the first [TFT] thin film transistor comprises an active layer in which [2 or greater number of] two or more channel [forming] regions connected in series are formed, and

wherein an equation of $W2/L2 \geq 5 \times W1/L1$ establishes where a channel length of the second [TFT] thin film transistor is L2, a channel width of the second [TFT] thin film transistor is W2, a channel length of the first [TFT] thin film transistor is L1 and a channel width of the first [TFT] thin film transistor is W1.

4. (Amended) An [electro-optical] electroluminescence display device according to claim 3, wherein the channel length of the second [TFT] thin film transistor (L2) is 0.1 to 50 mm, the channel width of the second [TFT] thin film transistor (W2) is 0.5 to 30 mm, the channel length of the first [TFT] thin film transistor (L1) is 0.2 to 18 mm and the channel width of the first [TFT] thin film transistor (W1) is 0.1 to 5 mm.

5. (Amended) An [electro-optical] electroluminescence display device according to claim 1, wherein the first [TFT] thin film transistor is a switching [TFT] thin film transistor and the second [TFT] thin film transistor is a current control [TFT] thin film transistor.

6. (Amended) An [electro-optical] electroluminescence display device according to claim 2, wherein the first [TFT] thin film transistor is a switching [TFT] thin film transistor and the second [TFT] thin film transistor is a current control [TFT] thin film transistor.

7. (Amended) An [electro-optical] electroluminescence display device according to claim 3, wherein the first [TFT] thin film transistor is a switching [TFT] thin film transistor and the second [TFT] thin film transistor is a current control [TFT] thin film transistor.

8. An [electro-optical] electroluminescence display device according to claim 1, wherein [a LDD region of the first TFT is formed so as not to overlap a gate electrode of the first TFT by interposing a gate insulating film therebetween, and a portion or all of a LDD region of the second TFT is formed so as to overlap a gate electrode of the second TFT] each of the first and second thin film transistors has at least one lightly doped impurity region between a channel region and one of source or impurity regions where the lightly doped impurity region of the first thin film transistor does not overlap a gate electrode of the first thin film transistor and the lightly doped impurity region of the second thin film transistor overlaps a gate electrode of the second thin film transistor at least partly.

9. An [electro-optical] electroluminescence display device according to claim 2, wherein [a LDD region of the first TFT is formed so as not to overlap a gate electrode of the first TFT by interposing a gate insulating film therebetween, and a portion or all of a LDD region of the second TFT is formed so as to overlap a gate electrode of the second TFT] each of the switching element and current control element has at least one lightly doped impurity region between a channel region and one of source or impurity regions where the lightly doped impurity region of the switching element does not overlap a gate electrode of the switching element and the lightly doped impurity region of the current control element overlaps a gate electrode of the current control element at least partly.

10. An [electro-optical] electroluminescence display device according to claim 3, wherein [a LDD region of the first TFT is formed so as not to overlap a gate electrode of the first TFT by interposing a gate insulating film therebetween, and a portion or all of a LDD region of the second TFT is formed so as to overlap a gate electrode of the second TFT] each of the switching element and the current control element has at least one lightly doped impurity region between a channel region and one of source or impurity regions where the lightly doped impurity region of the switching element does not overlap a gate electrode of the switching element and the lightly doped impurity region of the current control element overlaps a gate electrode of the current control element at least partly.

14. (Amended) An electronic device comprising the electroluminescence display device according to claim 1, wherein the electronic device is at least one selected from [a] the group consisting of a video camera, a digital camera, a goggle type display, a car navigation system, a personal computer, a mobile computer, a portable telephone, an electronic book, an image playback device using a recording medium[, which comprises an electro-optical device according to claim 1].

15. (Amended) An electronic device comprising the electroluminescence display device according to claim 2, wherein the electronic device is at least one selected from [a] the group consisting of a video camera, a digital camera, a goggle type display, a car navigation system, a personal computer, a mobile computer, a portable telephone, an electronic book, an image playback device using a recording medium[, which comprises an electro-optical device according to claim 2].

16. (Amended) An electronic device comprising the electroluminescence display device according to claim 3, wherein the electronic device is at least one selected from [a] the group consisting of a video camera, a digital camera, a goggle type display, a car navigation system, a personal computer, a mobile computer, a portable telephone, an electronic book, an image playback device using a recording medium[, which comprises an electro-optical device according to claim 3].